CLAIMS

Among my claims are:

1. An optical calibration trigger system for a servo controlled reciprocating rotary device, comprising:

an optical calibration rotor attached to a rotating element of said rotary device, said rotating element having a pre-determined full range of rotation, at least one light collimating slit in said rotor,

at least one stationary light emitter proximate one side of said rotor,

at least one stationary light detector proximate the other side of said rotor and directed towards said light emitter, rotation through said full range of said rotating element causing said slit to pass between said light emitter and said detector, passage of said slit between said light emitter and said light detector being equated with passage of said load through a unique, known fiducial position within said full range rotation of said rotating element, said detector configured for emitting an optical calibration trigger signal upon detection of light.

2. An optical calibration trigger system according to claim 1, said at least one collimating slit being two slits, said at least one light emitter being two light emitters, said at least one light detector being two light detectors, said rotary device configured for emitting said calibration trigger signal at each of two fiducial positions within said full range of rotation.

3. An optical calibration trigger system according to claim 2, said light emitters and said detectors being angularly adjustable with respect to said rotor and said slits so as to permit adjusting said fiducial position within said full range of rotation of said rotary device.

4. An optical calibration trigger system according to claim 3, said adjusting comprising selecting a percentage of offset spacing from the center of said full range of rotation.

5. An optical calibration trigger system according to claim 4, said reciprocating rotary device being a galvanometer, said load being a mirror.

6. An optical calibration trigger system according to claim 5, said light emitters having a remote light source.

7. An optical calibration trigger system according to claim 6, said remote light source having a control system for controlling light intensity of said light source.

8. A method for maintaining calibration of a position detector for an operating servo controlled reciprocating rotary device comprising the steps of: using a said servo controlled reciprocating rotary device configured with a calibration rotor rotationally locked to a rotating load thereof, a stationary light emitter proximate one side of said rotor, and a light detector proximate the other side of said rotor and directed towards said light emitter, said calibration rotor configured with a light collimating slit, said detector further configured for emitting a calibration trigger signal upon detection of light, passage of said load through a known fiducial position within full range of rotation of said load being associated with passage of said slit between said emitter and said detector, said position detector having a full range position sensor and a calibration database wherein each measured position is adjusted by a calibration error for generating a reported position,

comparing during operation of said rotary device, upon occurrence of a said calibration trigger signal, said known fiducial position to the concurrent said reported position of said position detector,

generating calibration corrections therefrom, and

applying said calibration corrections to said calibration database.

9. A method for maintaining calibration of a position detector for an operating servo controlled reciprocating rotary device according to claim 8, said fiducial position being two fiducial positions, said collimating slit being two slits, each said slit being associated with a respective said fiducial position, said light emitter being two light emitters, each said light emitter being associated with a respective said slit, said light detector being two light detectors, each said detector being associated with a respective said light emitter.

10. A method for maintaining calibration of a position detector for an operating servo controlled reciprocating rotary device according to claim 9, said steps further comprising

resolving said calibration corrections into gain and offset components, said applying said calibration corrections to said calibration database comprising extrapolating and adding said corrections to all cells of a gain and offset calibration database lookup table.

11. A method for maintaining calibration of a position detector according to claim 10, said rotary device being a galvanometer, said load being a mirror.

12. A servo controlled reciprocating rotary device with continuous calibration comprising a bi-directional motor, a main shaft, load, a full range angular position detector, a servo controller, and a continuous optical calibration system, said motor and said load being connected to said main shaft, said load having a full range of rotation of not more than 360 degrees, said position detector providing a reported position to said servo controller indicating the measured position of said load as corrected with calibration data, said servo controller connected for control inputs to said motor, said optical calibration system comprising

a rotor attached to said shaft, at least one collimating slit in said rotor, at least one stationary light emitter proximate one side of said rotor, at least one stationary light detector proximate the other side of said rotor and directed towards said light emitter, rotation of said load on said shaft causing said rotor to rotate a said slit between a said light emitter and a said detector, passage of said slit between said light emitter and said light detector being equated with passage of said load through a unique, predetermined fiducial position within said full range of rotation range of said load, said detector configured for emitting a calibration trigger signal upon detection of light,

said rotary device configured with circuitry for comparing upon occurrence of a said calibration trigger signal said fiducial position to a concurrent said reported position and generating additional calibration corrections therefrom, and for adding said additional calibration corrections to existing said calibration corrections.

13. A servo controlled reciprocating rotary device with continuous calibration system according to claim 12, said fiducial position being two fiducial positions, said at least one detector being

two detectors, each said detector associated with a respective said fiducial position, said at least one light emitter being two light emitters, each said light emitter being associated with a respective said detector, said at least one collimating slit being two slits, each said slit being associated with a respective said detector, said emitters, detectors and said rotary device configured for said emitting of a said calibration trigger signal when said load reaches either of said two fiducial positions.

14. A servo controlled reciprocating rotary device with continuous calibration system according to claim 13, said circuitry configured for resolving said calibration corrections into gain and offset components and for extrapolating and adding said gain and offset component to all cells of a gain and offset calibration correction lookup table.

15. A servo controlled reciprocating rotary device with continuous calibration system according to claim 14, said fiducial locations comprising a selected percentage of offset spacing from the center of said full range.

16. A servo controlled reciprocating rotary device with integral calibration system according to claim 15, said reciprocating rotary device being a galvanometer, said load being a mirror.

17. A two axis scanning system with a continuous optical calibration capability comprising

a scanner light beam source, two orthogonally arranged galvanometers, a target field of view, and a system controller,

each said galvanometer having a shaft, mirror, a full range position detector system for reporting the rotation angle of said mirror during operation, and a continuous optical calibration position reference system,

each said position detector system comprising an angular position sensor and calibration circuitry for generating a reported position from a said sensor measurement and a calibration correction lookup table containing gain and offset calibration data for each said axis,

each said optical calibration position reference system comprising a calibration rotor mounted on said shaft, at least one collimating slit in said rotor, at least one stationary light

emitter proximate one side of said rotor, at least one stationary light detector proximate the other side of said rotor and directed towards said light emitter, rotation through full range of motion of said mirror on said shaft causing said rotor to rotate said slit between said light emitter and said detector, passage of said slit between said light emitter and said light detector being equated with passage of said mirror through a known fiducial position within said full range of said mirror, said detector configured for sending a calibration trigger signal to said calibration circuitry upon detection of light,

said calibration circuitry configured for comparing upon occurrence of said calibration trigger signal said fiducial position to said reported position of said position detector and generating further calibration corrections therefrom, and for adding said further calibration corrections to said calibration corrections already in said lookup table.

18. A two axis scanning system according to claim 17, said at least one collimating slit being two slits, said at least one light emitter being two light emitters, said at least one light detector being two light detectors, said rotary device configured for said sending of a said calibration trigger signal to said circuitry when said load passes either of two fiducial positions within said full range.

19. A galvanometer with integral continuing calibration capability, comprising:

a servo motor and drive shaft,

a load attached to said drive shaft,

an angular position detector circuit and a calibration look up table,

a light emitter,

a light detector directed towards said light emitter,

a rotor mounted on said shaft between said light emitter and said light detector, said rotor having at least one collimating light slit, said slit configured to rotate between said light emitter and said detector at a pre-selected fiducial position within the normal arc of motion of said drive shaft, and

circuitry for sampling the measured position of said load as calculated by said angular position detector circuit and said calibration look up table at the moment said detector senses

light, for comparing said reference position to said measured position, for calculating therefrom an error correction value, and for applying said error correction value to said look up table.

20. A two axis scanning system according to claim 19, said light slit being two light slits, said light emitter being two light emitters, said light detector being two light detectors, each said light detector associated with a respective said fiducial position.

21. A method for maintaining calibration of a partial rotation rotary device for driving a reciprocating load member comprising the steps of:

providing a calibration rotor locked to the reciprocating load member, said calibration rotor including at least one collimating slit for passing an emitted light therethrough;

illuminating the slit from a first side of the calibration rotor;

detecting collimated illumination that passes through the slit;

emitting a calibration trigger signal thereupon;

comparing the measured position of said reciprocating member at the time of the occurrence of said calibration trigger signal with an assumed correct position; and,

generating a calibration correction value set based on the compared values.

22. The method of claim 21 further comprising the steps of:

providing a second collimating slit on the calibration rotor;

detecting collimated illumination that passes through the second collimating slit;

emitting a second calibration trigger thereupon;

comparing the measured position of said reciprocating member at the time of the occurrence of said second calibration trigger signal with an assumed second correct position; and,

generating a second calibration correction value set based on the compared values.